

# NPN Silicon Power Darlington Transistors

## MJE5740, MJE5742

The MJE5740 and MJE5742 Darlington transistors are designed for high-voltage power switching in inductive circuits.

### Features

- These Devices are Pb-Free and are RoHS Compliant\*

### Applications

- Small Engine Ignition
- Switching Regulators
- Inverters
- Solenoid and Relay Drivers
- Motor Controls

### MAXIMUM RATINGS

Symbol	Rating	Value	Unit
$V_{CEO(sus)}$	Collector–Emitter Voltage MJE5740 MJE5742	300 400	Vdc
$V_{CEV}$	Collector–Emitter Voltage MJE5740 MJE5742	600 800	Vdc
$V_{EB}$	Emitter–Base Voltage	8	Vdc
$I_C$ $I_{CM}$	Collector Current – Continuous – Peak (Note 1)	8 16	A dc
$I_B$ $I_{BM}$	Base Current – Continuous – Peak (Note 1)	2.5 5	A dc
$P_D$	Total Device Dissipation @ $T_A = 25^\circ C$ Derate above $25^\circ C$	2 0.016	W W/ $^\circ C$
$P_D$	Total Device Dissipation @ $T_C = 25^\circ C$ Derate above $25^\circ C$	100 0.8	W W/ $^\circ C$
$T_J, T_{stg}$	Operating and Storage Junction Temperature Range	-65 to +150	$^\circ C$

### THERMAL CHARACTERISTICS

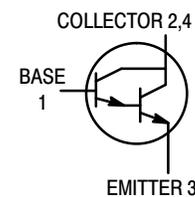
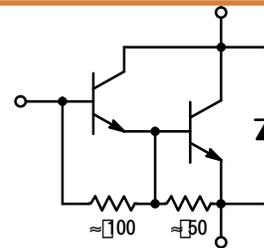
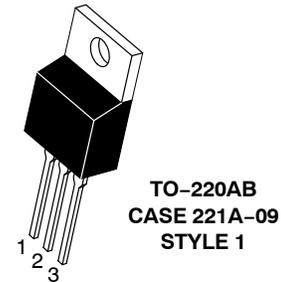
Symbol	Characteristics	Max	Unit
$R_{\theta JC}$	Thermal Resistance, Junction-to-Case	1.25	$^\circ C/W$
$R_{\theta JA}$	Thermal Resistance, Junction-to-Ambient	62.5	$^\circ C/W$
$T_L$	Maximum Lead Temperature for Soldering Purposes 1/8" from Case for 5 Seconds	275	$^\circ C$

Stresses exceeding those listed in the Maximum Ratings table may damage the device. If any of these limits are exceeded, device functionality should not be assumed, damage may occur and reliability may be affected.

1. Pulse Test: Pulse Width = 5 ms, Duty Cycle  $\leq 10\%$ .

\*For additional information on our Pb-Free strategy and soldering details, please download the [onsemi Soldering and Mounting Techniques Reference Manual, SOLDERRM/D](#).

## POWER DARLINGTON TRANSISTORS 8 AMPERES 300–400 VOLTS 80 WATTS



### MARKING DIAGRAM



MJE574x = Device Code  
x = 0 or 2  
G = Pb-Free Package  
A = Assembly Location  
Y = Year  
WW = Work Week

### ORDERING INFORMATION

See detailed ordering and shipping information in the package dimensions section on page 6 of this data sheet.

NOTE: Some of the devices on this data sheet have been **DISCONTINUED**. Please refer to the table on page 6.

# MJE5740, MJE5742

## ELECTRICAL CHARACTERISTICS (T<sub>C</sub> = 25°C unless otherwise noted)

Symbol	Characteristic	Min	Typ	Max	Unit
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### OFF CHARACTERISTICS (Note 2)

V <sub>CEO(sus)</sub>	Collector–Emitter Sustaining Voltage (I <sub>C</sub> = 50 mA, I <sub>B</sub> = 0)	MJE5740	300	–	–	Vdc
		MJE5742	400	–	–	
I <sub>CEV</sub>	Collector Cutoff Current (V <sub>CEV</sub> = Rated Value, V <sub>BE(off)</sub> = 1.5 Vdc) (V <sub>CEV</sub> = Rated Value, V <sub>BE(off)</sub> = 1.5 Vdc, T <sub>C</sub> = 100°C)	–	–	1	mAdc	
		–	–	5		
I <sub>EBO</sub>	Emitter Cutoff Current (V <sub>EB</sub> = 8 Vdc, I <sub>C</sub> = 0)	–	–	75	mAdc	

### SECOND BREAKDOWN

I <sub>S/b</sub>	Second Breakdown Collector Current with Base Forward Biased	See Figure 6			
RBSOA	Clamped Inductive SOA with Base Reverse Biased	See Figure 7			

### ON CHARACTERISTICS (Note 2)

h <sub>FE</sub>	DC Current Gain (I <sub>C</sub> = 0.5 Adc, V <sub>CE</sub> = 5 Vdc) (I <sub>C</sub> = 4 Adc, V <sub>CE</sub> = 5 Vdc)	50	100	–	–
		200	400	–	
V <sub>CE(sat)</sub>	Collector–Emitter Saturation Voltage (I <sub>C</sub> = 4 Adc, I <sub>B</sub> = 0.2 Adc) (I <sub>C</sub> = 8 Adc, I <sub>B</sub> = 0.4 Adc) (I <sub>C</sub> = 4 Adc, I <sub>B</sub> = 0.2 Adc, T <sub>C</sub> = 100°C)	–	–	2	Vdc
		–	–	3	
		–	–	2.2	
V <sub>BE(sat)</sub>	Base–Emitter Saturation Voltage (I <sub>C</sub> = 4 Adc, I <sub>B</sub> = 0.2 Adc) (I <sub>C</sub> = 8 Adc, I <sub>B</sub> = 0.4 Adc) (I <sub>C</sub> = 4 Adc, I <sub>B</sub> = 0.2 Adc, T <sub>C</sub> = 100°C)	–	–	2.5	Vdc
		–	–	3.5	
		–	–	2.4	
V <sub>f</sub>	Diode Forward Voltage (Note 3) (I <sub>F</sub> = 5 Adc)	–	–	2.5	Vdc

### SWITCHING CHARACTERISTICS

#### Typical Resistive Load (Table 1)

t <sub>d</sub>	Delay Time	(V <sub>CC</sub> = 250 Vdc, I <sub>C(pk)</sub> = 6 A I <sub>B1</sub> = I <sub>B2</sub> = 0.25 A, t <sub>p</sub> = 25 μs, Duty Cycle ≤ 1%)	–	0.04	–	μs
t <sub>r</sub>	Rise Time		–	0.5	–	μs
t <sub>s</sub>	Storage Time		–	8	–	μs
t <sub>f</sub>	Fall Time		–	2	–	μs

#### Inductive Load, Clamped (Table 1)

t <sub>sv</sub>	Voltage Storage Time	(I <sub>C(pk)</sub> = 6 A, V <sub>CE(pk)</sub> = 250 Vdc I <sub>B1</sub> = 0.06 A, V <sub>BE(off)</sub> = 5 Vdc)	–	4	–	μs
t <sub>c</sub>	Crossover Time		–	2	–	μs

Product parametric performance is indicated in the Electrical Characteristics for the listed test conditions, unless otherwise noted. Product performance may not be indicated by the Electrical Characteristics if operated under different conditions.

2. Pulse Test: Pulse Width 300 μs, Duty Cycle = 2%.

3. The internal Collector–to–Emitter diode can eliminate the need for an external diode to clamp inductive loads. Tests have shown that the Forward Recovery Voltage (V<sub>f</sub>) of this diode is comparable to that of typical fast recovery rectifiers.

TYPICAL CHARACTERISTICS

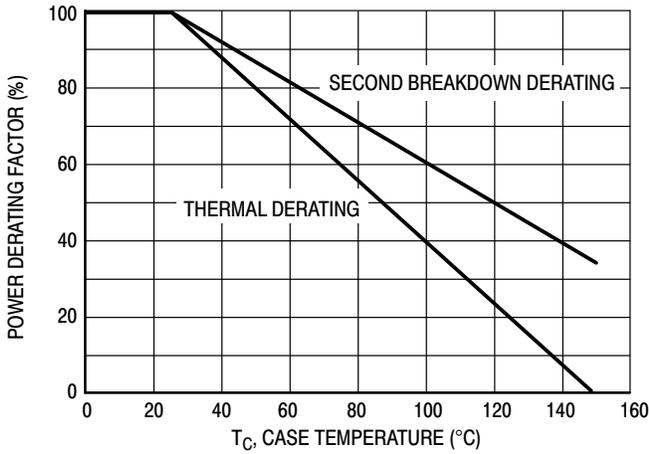


Figure 1. Power Derating

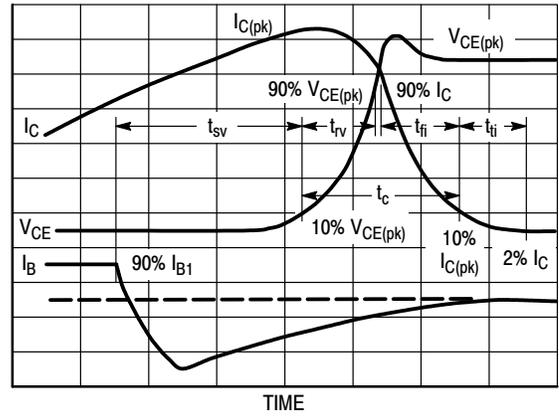


Figure 2. Inductive Switching Measurements

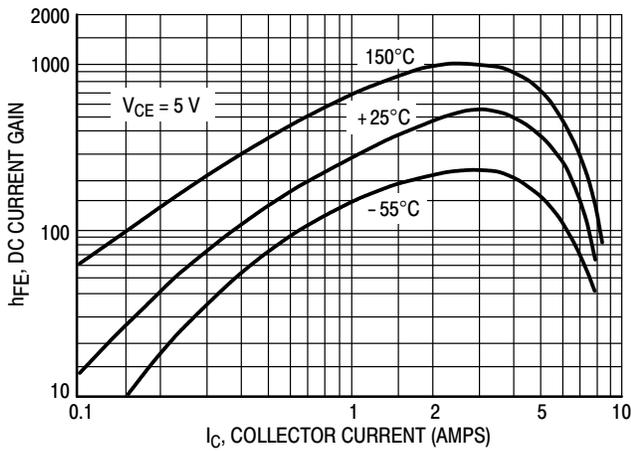


Figure 3. DC Current Gain

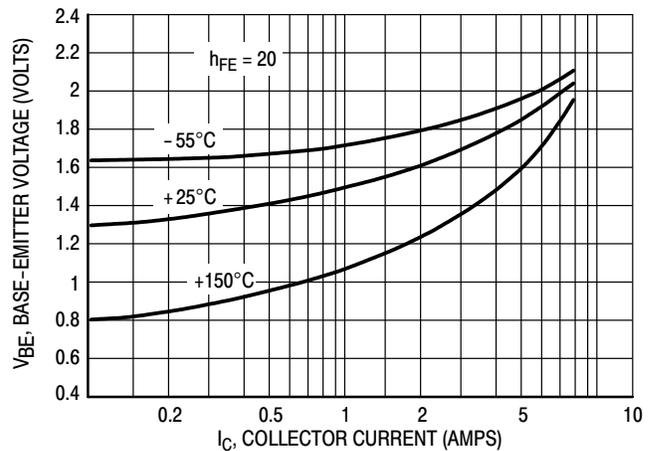


Figure 4. Base-Emitter Voltage

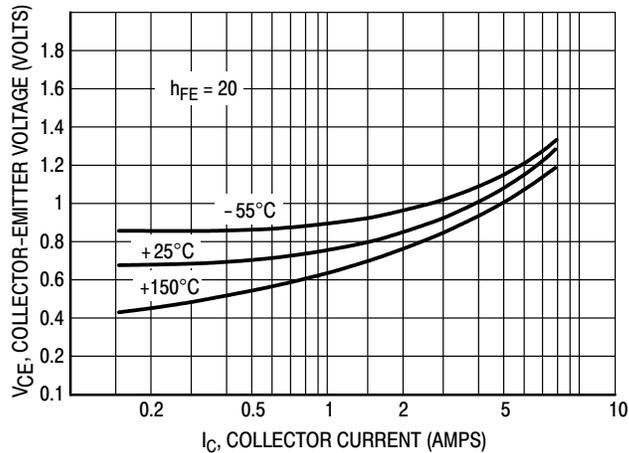


Figure 5. Collector-Emitter Saturation Voltage

# MJE5740, MJE5742

Table 1. Test Conditions for Dynamic Performance

	REVERSE BIAS SAFE OPERATING AREA AND INDUCTIVE SWITCHING	RESISTIVE SWITCHING
<p><b>TEST CIRCUITS</b></p>	<p>DUTY CYCLE <math>\leq 10\%</math>  <math>t_r, t_f \leq 10 \text{ ns}</math></p> <p><b>NOTE:</b>          PW and <math>V_{CC}</math> Adjusted for Desired <math>I_C</math>  <math>R_B</math> Adjusted for Desired <math>I_{B1}</math></p>	
<p><b>CIRCUIT VALUES</b></p>	<p>COIL DATA:          FERROXCUBE CORE #6656          FULL BOBBIN (~16 TURNS) #16</p> <p>GAP FOR 200 <math>\mu\text{H}/20 \text{ A}</math>  <math>L_{\text{coil}} = 200 \mu\text{H}</math></p> <p><math>V_{CC} = 30 \text{ V}</math>  <math>V_{CE(\text{pk})} = 250 \text{ Vdc}</math>  <math>I_{C(\text{pk})} = 6 \text{ A}</math></p>	<p><math>V_{CC} = 250 \text{ V}</math>  <math>D1 = 1\text{N}5820 \text{ OR EQUIV.}</math></p>
<p><b>TEST WAVEFORMS</b></p>	<p><b>OUTPUT WAVEFORMS</b></p> <p><math>t_1</math> ADJUSTED TO OBTAIN <math>I_C</math></p> $t_1 \approx \frac{L_{\text{coil}} (I_{C(\text{pk})})}{V_{CC}}$ <p>TEST EQUIPMENT          SCOPE-TEKTRONICS          475 OR EQUIVALENT</p> $t_2 \approx \frac{L_{\text{coil}} (I_{C(\text{pk})})}{V_{\text{clamp}}}$	<p><math>t_r, t_f &lt; 10 \text{ ns}</math>          DUTY CYCLE = 1%  <math>R_B</math> AND <math>R_C</math> ADJUSTED FOR DESIRED <math>I_B</math> AND <math>I_C</math></p>

# MJE5740, MJE5742

## SAFE OPERATING AREA INFORMATION

### FORWARD BIAS

There are two limitations on the power handling ability of a transistor: average junction temperature and second breakdown. Safe operating area curves indicate  $I_C - V_{CE}$  limits of the transistor that must be observed for reliable operation; i.e., the transistor must not be subjected to greater dissipation than the curves indicate.

The data of Figure 6 is based on  $T_C = 25^\circ\text{C}$ ;  $T_{J(pk)}$  is variable depending on power level. Second breakdown pulse limits are valid for duty cycles to 10% but must be derated when  $T_C \geq 25^\circ\text{C}$ . Second breakdown limitations do not derate the same as thermal limitations. Allowable current at the voltages shown on Figure 6 may be found at any case temperature by using the appropriate curve on Figure 1.

The Safe Operating Area figures shown in Figures 6 and 7 are specified ratings for these devices under the test conditions shown.

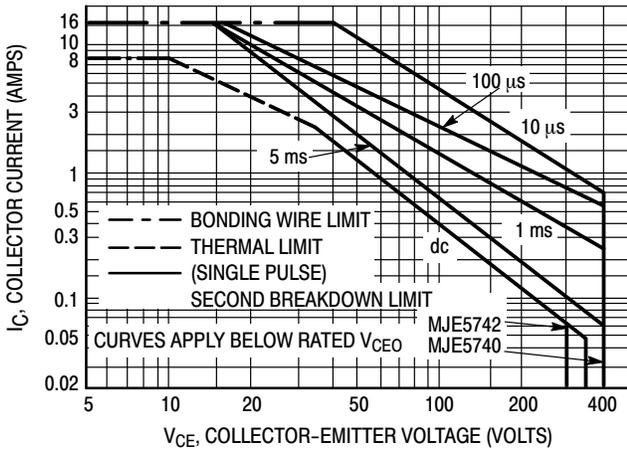


Figure 6. Forward Bias Safe Operating Area

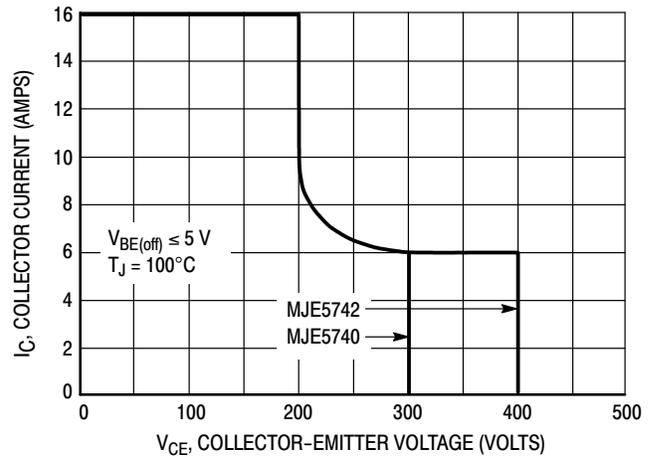


Figure 7. Reverse Bias Safe Operating Area

## RESISTIVE SWITCHING PERFORMANCE

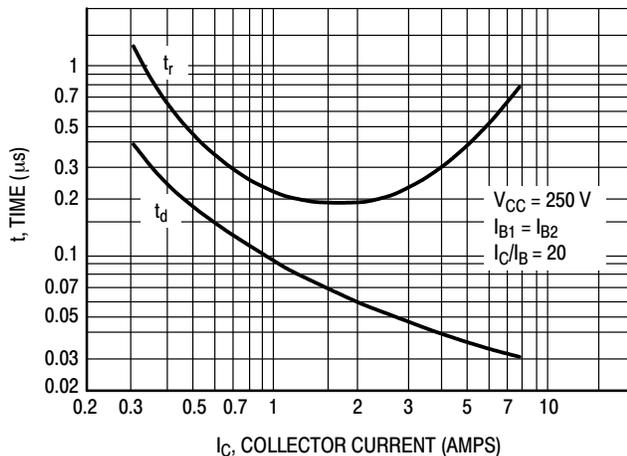


Figure 8. Turn-On Time

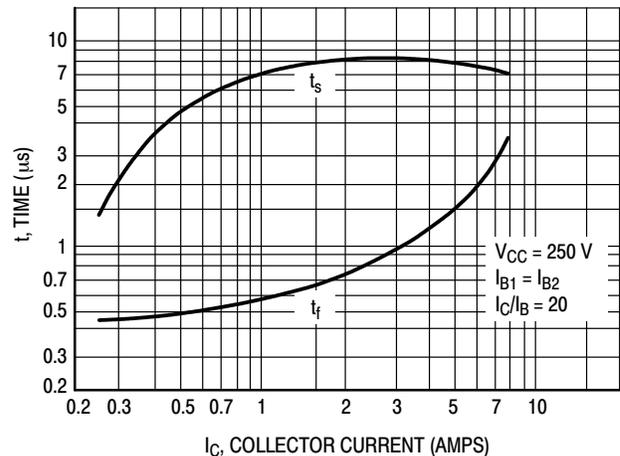


Figure 9. Turn-Off Time

## MJE5740, MJE5742

### ORDERING INFORMATION

Device	Package	Shipping
MJE5742G	TO-220 (Pb-Free)	50 Units / Rail

### DISCONTINUED (Note 4)

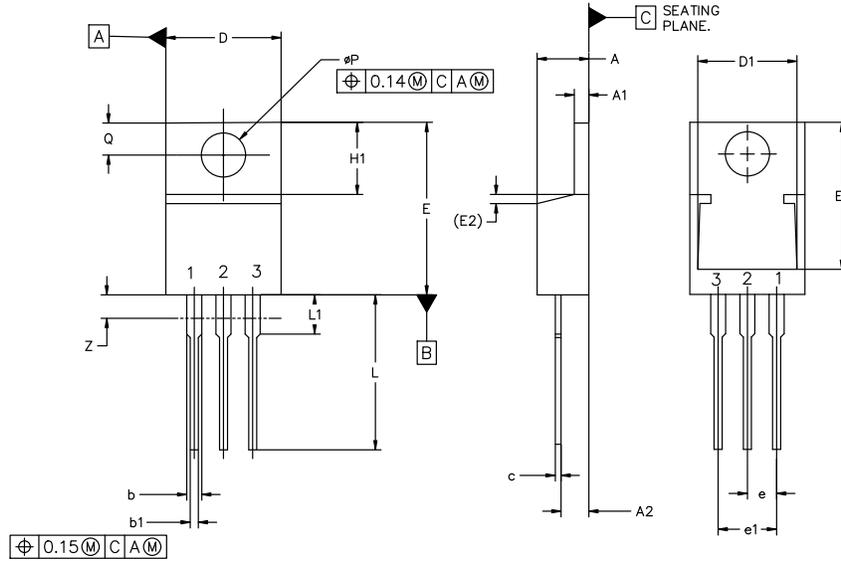
MJE5740G	TO-220 (Pb-Free)	50 Units / Rail
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4. **DISCONTINUED:** This device is not recommended for new design. Please contact your **onsemi** representative for information. The most current information on this device may be available on [www.onsemi.com](http://www.onsemi.com).



TO-220-3 10.10x15.12x4.45, 2.54P  
CASE 221A  
ISSUE AL

DATE 05 FEB 2025



MILLIMETERS			
DIM	MIN	NOM	MAX
A	4.07	4.45	4.83
A1	1.15	1.28	1.41
A2	2.04	2.42	2.79
b	1.15	1.34	1.52
b1	0.64	0.80	0.96
c	0.36	0.49	0.61
D	9.66	10.10	10.53
D1	8.43	8.63	8.83
E	14.48	15.12	15.75
E1	12.58	12.78	12.98
E2	1.27 REF		

MILLIMETERS			
DIM	MIN	NOM	MAX
e	2.42	2.54	2.66
e1	4.83	5.08	5.33
H1	5.97	6.22	6.47
L	12.70	13.49	14.27
L1	2.80	3.45	4.10
Q	2.54	2.79	3.04
φP	3.60	3.85	4.09
Z	---	---	3.48

- NOTES:
1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 2018.
  2. CONTROLLING DIMENSION: MILLIMETERS.
  3. DIMENSION Z DEFINES A ZONE WHERE ALL BODY AND LEAD IRREGULARITIES ARE ALLOWED.

- |  |  |   |  |
|--|--|---|--|
| <p>STYLE 1:<br/>PIN 1. BASE<br/>2. COLLECTOR<br/>3. EMITTER<br/>4. COLLECTOR</p> | <p>STYLE 2:<br/>PIN 1. BASE<br/>2. EMITTER<br/>3. COLLECTOR<br/>4. EMITTER</p> | <p>STYLE 3:<br/>PIN 1. CATHODE<br/>2. ANODE<br/>3. GATE<br/>4. ANODE</p>    | <p>STYLE 4:<br/>PIN 1. MAIN TERMINAL 1<br/>2. MAIN TERMINAL 2<br/>3. GATE<br/>4. MAIN TERMINAL 2</p> |
| <p>STYLE 5:<br/>PIN 1. GATE<br/>2. DRAIN<br/>3. SOURCE<br/>4. DRAIN</p>          | <p>STYLE 6:<br/>PIN 1. ANODE<br/>2. CATHODE<br/>3. ANODE<br/>4. CATHODE</p>    | <p>STYLE 7:<br/>PIN 1. CATHODE<br/>2. ANODE<br/>3. CATHODE<br/>4. ANODE</p> | <p>STYLE 8:<br/>PIN 1. CATHODE<br/>2. ANODE<br/>3. EXTERNAL TRIP/DELAY<br/>4. ANODE</p>              |
| <p>STYLE 9:<br/>PIN 1. GATE<br/>2. COLLECTOR<br/>3. EMITTER<br/>4. COLLECTOR</p> | <p>STYLE 10:<br/>PIN 1. GATE<br/>2. SOURCE<br/>3. DRAIN<br/>4. SOURCE</p>      | <p>STYLE 11:<br/>PIN 1. DRAIN<br/>2. SOURCE<br/>3. GATE<br/>4. SOURCE</p>   | <p>STYLE 12:<br/>PIN 1. MAIN TERMINAL 1<br/>2. MAIN TERMINAL 2<br/>3. GATE<br/>4. NOT CONNECTED</p>  |

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